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DIFFERENCES IN READING ABILITY, AND USE OF A STORY SCHEMA IN RECONSTRUCTING AND RECALLING INFORMATION

University — Université

UNIVERSITY OF ALBERTA

Degree for which thesis was presented — Grade pour lequel cette thèse fut présentée

MASTER OF EDUCATION

Year this degree conferred — Année d'obtention de ce grade

1984

Name of Supervisor — Nom du directeur de thèse

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DIFFERENCES IN READING ABILITY AND USE OF A STORY SCHEMA IN RECONSTRUCTING AND RECALLING INFORMATION

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL, 1984

THE UNIVERSITY OF ALBERTA

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Abstract

This study was focused on the differences between good and poor readers in their use of a story schema in recall and reconstruction tasks. Above and below average comprehenders in grade six heard a story either in canonical or interleaved format. They were instructed to recall the story and reconstruct the order of story events either exactly as they heard it or as it should be. The procedure was repeated in a second phase. Comparison of performance in the different conditions showed that poor readers could use a story schema in the reconstruction task when the story followed canonical format. However, their story schema was not as well-developed or as efficiently utilized as good readers'. Both the recall and reconstruction data provided evidence that schematic retrieval is not obligatory for either reading group, but neither good nor poor readers were very successful in reproducing interleaved stories. Good readers could use a story schema whencued to do so in any task, while poor readers could only do so in the reconstruction task. Differential improvement of poor readers' performance due to explicit cuing in the second phase was obtained in the reconstruction task. The different patterns of performance obtained in the recall and reconstruction tasks demonstrated the importance of assessing good and poor readers' performance under different task demands. In addition, methodological problems related to using a recall task alone in contrastive research of this type are discussed.

Acknowledgements

I wish to acknowledge my indebtedness to all those who assisted in bringing this research to a successful conclusion. First, I would like to express my sincere gratitude to Dr. Gay Bisanz for her supervision and the support and understanding she has extended throughout all phases of this thesis. Sincere appreciation is extended to Dr. J.P. Das who played an important role during my M.Ed. program. I am grateful for his advice and stimulation. I would also like to thank Dr. Linda Nosbush, my external examiner, for her positive comments.

In addition, I wish to thank Dr. Steve Hunka for his suggestions regarding data analysis and Dr. Jean Mandler for her suggestions regarding the instructions and stories used in the study.

I also owe a debt of gratitude to the principals, teachers and students of the Edmonton Public Schools. Their cooperation contributed to the successful collection of data of the study.

Finally, I would like to express my appreciation to my husband, Mahfuz, for his continuing encouragement.

Differences in Reading Ability and Use of a Story Schema
in Reconstructing and Recalling Information

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Introduction

The present research was designed to explore whether or not children varying in reading ability evidence differences in employing story schemata, i.e., knowledge about story structures. The primary questions examined were: (a) Do good and poor readers differ in their retrieval of stories according to a story schema?; (b) Is retrieving a story schematically obligatory for good and poor readers, or do these readers differ in their ability to use an alternate retrieval strategy?; and (c) Do these types of readers differ in their ability to use a story schema when explicitly cued to do so? More specifically, the purpose was to see how input order, canonical and interleaved (to be defined later), influences good and poor readers' ability to recall and reconstruct story information. In the following sections of this paper previous studies related to these questions are described and a rationale for the design of the present research is provided.

Story Schemata and Story Grammars

Within the information processing framework, there are two contrasting conceptions regarding the way different components of the discourse comprehension system interact. One conception, which is referred to as "bottom-up" processing, emphasizes that comprehension depends on the features of textual input, e.g., letter and word recognition. In the alternate conception, "top-down" processing, discourse comprehension is regarded as being a conceptually-driven or schema-based process.

The term "schema" comes into psychology most directly from Bartlett (1932). In his pioneering work on memory, Bartlett posited that

information is encoded and retrieved from memory with the aid of schemata. Schemata were thought to be skeletal structures of sorts, consisting of the invariant aspects of concepts that are stored in memory. According to Anderson (1977) and Ausubel (1963) these structures help individuals to anchor new information during reading or listening to discourse. In the current literature, terms such as frames (Minsky, 1975), scripts (Schank & Ableson, 1977), schematic superstructures (van Dijk & Kintsch, 1983), and schemata (Rumelhart, 1975) are used to refer to the mental structures that aid in discourse comprehension. The viewpoints underlying these concepts imply that strategies for comprehension are controlled principally by the reader or listener on the basis of the prior knowledge that he or she brings to the reading task. This includes knowledge of prior discourse context, goals and world knowledge, and expectations about discourse structures.

Within psychology, Rumelhart (1975) was the first to propose formally that stories, like sentences, can have an internal structure. He developed a "story grammar theory" that was an attempt to describe the higher level of organization that takes place in stories that does not take place in strings of sentences. Following Rumelhart, a number of researchers (Mandler & Johnson, 1977; Stein & Glenn, 1979; Thorndyke, 1977) came up with closely related story grammars. These researchers theorized that stories have an internal structure and that knowledge about the story structure which forms a "story schema" is used in deriving an organized representation of the information in stories.

A story schema is the mental representation that reflects the regularities of underlying story structure described by story grammar

theories. This structure can be represented as a tree structure which makes explicit the constituent units of the story and the relations between units. According to Mandler and Johnson (1977), a story begins with a setting and an event structure. An event structure consists of an episode or number of episodes. An episode starts with a beginning node which causes a development. The development is composed of a reaction node, that gives rise to a goal node, which in turn causes attempt and outcome nodes. Finally, an episode is closed by an ending node. Episodes can be connected causally, sequentially or temporally. Causal connections between episodes occur through the embedding property of the beginning or outcome or ending nodes (Johnson & Mandler, 1980). Thus, story grammar theories specify the nodes a passage should have in order to be considered a story; they also identify the prototypical or canonical order of nodes in the passage. Mandler and Johnson's story grammar has been discussed because it offers a more detailed analysis of the nodes comprising a story. "This grammar fulfills the formal requirements that are necessary for an adequate story grammar" (Black & Wilnesky, 1979; p. 220). (For a comparative discussion on story grammars see Black and Wilnesky, 1979 or Reder, 1978).

According to Mandler (1978), the story schema described by story grammar theories "consists of a set of expectations about stories, about the units of which they are composed, the way they are sequenced and the types of connections between units that are likely to occur" (p. 15). These sets of expectations guide comprehension and direct the encoding and retrieval of story information. It has been shown repeatedly, that a story's structure influences memory processes and comprehension. A number of

researchers (e.g., Kintsch, 1977; Glenn, 1978; Mandler, 1978; Baker & Stein, 1981; Stein & Nezworski, 1978) have reported that stories that violate the ideal structure are less well recalled in terms of quantity (amount/time) and/or quality (more inversions and distortions) compared to canonical or well-formed stories. In addition, recall conformed more to an ideal structure than to the presented text structure.

Structures of stories are found to be both familiar and obvious even to children. Studies (Mandler, 1978; Mandler & Deforest, 1979; Stein & Glenn, 1979) have shown that young children are sensitive to the structures of stories and use knowledge about structure to order recall without specific instruction. Stein and Glenn (1979) demonstrated that children as young as six are capable of organising and sequencing story information which reflects the story grammar. In addition, the pattern of schematic recall of well-formed stories has been found to be invariant cross-culturally (Mandler, Scribner, Cole, & DeForest, 1980) and developmentally (Mandler & Johnson, 1977; Mandler, 1978; Stein & Glenn, 1979).

Finally, developmental studies focused on story production or recall of scrambled stories, (e.g., Buss, Yussen, Mathews, Miller, & Rembold, 1983; Mandler, 1978; Mandler & DeForest, 1979; Whaley, 1981) have shown that by grade six normal children have developed adequate story schemata. However, it is not yet clear how and under what conditions story schemata develop. It is suggested that to develop a story schema one has to integrate and incorporate experiences with stories, their constituent units and the relations among the units into a knowledge system. Story schemata are said to be acquired through experiences with typical kinds of causal and

temporal event sequences in the world and by listening to stories including how they typically begin and end (Mandler & Johnson, 1977; Mandler, 1978). Thus, with age, story schemata should become richer and more elaborate (Fitzgerald & Spiegel, 1983).

Given this speculation about the normal course of development, one interesting issue is whether or not there are individual differences in schema acquisition that occur with age and whether such differences are related to individual differences in reading skill.

Schema Research Comparing Good and Poor Readers

Frederickson (1979) and Weaver (1978) have suggested that there may be fundamental differences in readers' approach to discourse comprehension. After reviewing the existing literature on the problems of poor readers, Weaver (1978) speculated that poor readers may suffer from an inability to use structures of information in constructing meaning from units of discourse. Gibson and Levin (1975) noted that good and poor readers do not necessarily differ in decoding ability; rather readers who can decode but have not learned to organize text into higher order groupings may still be poor readers. Bruce (1978) feels that a failure to understand structure could be an important factor in reading disability.

A few early studies (deHirsch, Jansky & Langford, 1966; Fry, Johnson & Muel, 1970; Smiley, Worthen, Campione & Brown, 1977) provided evidence that problem readers may be deficient in their ability to use structural information in telling and remembering stories. Using a story recall task, deHirsch et al. reported that problem readers were "unable to grasp the essential parts of a story and to place them in proper relation to the whole"(p. 48). Using a story production task, Fry et al. observed

that below average readers are "less adept than the 'above average readers' at organizing and integrating the details in the stimulas" and "telling a coherent story about it"(p. 137). Smiley et al. who compared good and poor readers' recall of 'thematically relevant material' from stories, indicated that poor readers remembered and comprehended less than good readers. Furthermore, poor readers were said to be less sensitive to structural importance compared to good readers. These studies are not directly related to story schemata because none of these researchers formally defined the structure of stories. Thus, given the measures they used, it is not possible to conclude that poor readers are deficient in knowledge about the structure of stories. However, on the basis of this research, it can be speculated that poor readers lack an adequate story schema.

More recently, groups of researchers (Fitzgerald & Spiegel, 1983; Sciendenberg 1982; Townsend, 1982; Worden, Milgram, & Gaboure, 1982; Weaver & Dickson, 1982; Whaley, 1981) have advocated the application of schema theory in understanding reading failure. These researchers imply that readers who are experiencing difficulties may not have developed the appropriate schemata for understanding discourse, or given an appropriate schema, may not utilize it appropriately.

Worden et. al. (1982), assessed learning disabled (LD) adults' sensitivity to story structure through recall. Their subjects listened to two ideal stories. Twenty four hours later they were cued with a story title and asked to recall those stories. The results showed that LD adults' ability to recall the structural nodes of stories was similar to normal third grade children. In a later experiment, they observed improvement, although not significant, after a brief training on story grammar. Weaver and

Dickson (1982) compared the story grammar approach with a "change analysis" method to account for differences between disabled and normal readers (approximately 13 years of age). They found significant differences between disabled and normal readers in their recall of only reaction and minor setting nodes. But, disabled readers were found to produce a more reduced version of a story. These investigators concluded that story grammar theory can be used as a diagnostic tool, though in a limited context. Sciendenberg (1982) discussed the implications of schema theory in the context of poor comprehenders problems in understanding discourse. He mentioned that there are some poor readers who acquire word recognition skills but unable to recognize and combine linguistic units in a discourse. Townsend (1982) assessed good and poor readers' abililty to shift schemata in order to understand passages with different contents. His results suggested that third grade children experience difficulty in schema shifting but it is no more difficult for poor readers than good readers. However, he focused on schemata relevant to the content rather than the structure of discourse.

Finally, Fitzgerald and Spiegel (1983) compared the effectiveness of instruction to increase knowledge of story structure as defined by story grammar theory versus instruction to increase knowledge of words (decoding, meaning and vocabulary) on comprehension. In order to do so, they identified twenty below average readers who lacked knowledge of story structure, as measured by story production and scrambled story recall tasks. They found that instruction on story grammar had a strong positive effect on reading comprehension compared to the instruction on word study. The screening tasks used in this study provide some direct evidence that there

are poor readers who lack knowledge of story structure. However, since the study focused on training a special group of grade four students, it is difficult to assess the extent of the problem among poor readers of different ages.

The above researchers have applied schema theory in its various aspects to study problems of disabled readers. None of them, except Fitzgerald and Spiegel (1983), has directly addressed the issue of whether or not young poor readers have developed story schemata as well as good readers because this issue cannot be addressed by simply comparing the patterns of recall for well-formed stories or the content of passages; such comparisons do not tap the inherent temporal organization of story schemata. Further, research is needed to determine whether or not good readers have a better grasp of story structure than poor readers at different ages and stages of reading acquisition (Rand, 1984; Whaley, 1981).

Story Reordering and Production Tasks

To assess knowledge of story structure generally two tasks are used in the literature, namely, a scrambled story recall task (Kintsch, Mandel,& Kozminsky, 1977; Mandler, 1978; Mandler & DeForest, 1979; Stein & Nezworski, 1978) and a story production task (e.g., Botvin & Sutton-Smith, 1977; Fitzgerald & Spiegel, 1983). Prior research has demonstrated that these two tasks have been useful for revealing developmental differences. "Therefore, it was likely that they would also be sensitive to individual differences within a given age level" (Fitzgerald & Spiegel, 1983; p. 4).

The order of nodes and logical relations between nodes which is revealed in their order are the critical components of story grammar theory, and likewise, story schemata. If a schema is activated then retrieval order should correspond to ideal order, i.e., canonical order. This happens in case of normal readers when story input order follows canonical order. If retrieval order follows canonical order even when input order violates the ideal order, that provides a powerful test of the influence of story schemata. For example, Thorndyke (1977) found that displacing certain nodes at input resulted in a tendency to recall them in ideal order. As mentioned earlier, Kintsch et al. (1977), Mandler (1978), Stein and Nezworski (1978) found that normal readers tended to recall stories in ideal order even after listening to stories in scrambled order. Since production tasks are quite demanding and have the potential to underestimate competence, reproduction of scrambled stories would seem to be the best means to assess knowledge of story structure in poor readers.

One form of scrambling or violating canonical order is to present the story in interleaved order. In this order, episodes contain all the basic nodes in correct order, but the episodes are mixed together (an example is given in Method section). Interleaved form disrupts the connectedness between nodes. It requires more processing than ideal stories (Mandler, 1978). As such it would be difficult to maintain interleaved order in reproduction compared to ideal order especially for somebody who relied on story schemata for retrieval. Mandler (1978) compared the recall of canonical and interleaved stories of students in grades two, four, six, and in university. (The correlation between canonical and interleaved orders was .67.) The difficulty of recalling the interleaved order was reflected in the

quantity (poor amount of recall) and quality (more distortions, inversions) of recall. The major finding was that subjects were able to maintain the interleaved input order fairly well through the beginning, but then tended to revert to the ideal structural order to sequence the rest.

Since this study did not allow one to determine whether retrieval guided by a story schema is merely a preferred route or generally a successfull one, Mandler and DeForest (1979) conducted another study with children in grades three and six, and adults. This study examined whether or not subjects could maintain an input order other than the ideal order when specifically instructed to do so. As such, different groups of subjects heard the stories either in canonical or interleaved format. In two conditions, subjects were instructed to maintain the input order (either canonical or interleaved) in recall; while in a third condition, subjects heard interleaved stories and they were asked to recall in canonical order (for a detailed description of conditions see the Method section of this paper). After hearing the stories in canonical order, all the subjects sequenced their output appropriately. Even in the interleaved story condition, almost all subjects were able to recall the stories in canonical format when asked to do so: The Relative Ratio of Repetition (RRR) scores were .91 in 3rd grade, .98 in 6th grade, and .98 for adults. (RRR would be 0, if recall was perfectly interleaved; RRR would be 1.0, if recall was perfectly separated into two episodes.) But subjects were poor at interleaving the stories. It was found that younger children followed the canonical order (RRR=.71) more than sixth graders (RRR=.58); While the latter group followed the canonical order more than the adults (RRR=.48). The sequence of sixth graders' and adults' recall followed an order that

was intermediate to canonical and interleaved order. In the previous study, when no interleaving instructions were given, the tendency was to follow the canonical order in both third (RRR=.72) and sixth (RRR=.68) grade children; where as the adults' performance did not change very much (RRR=.52). Thus, compared to children, adults were found to be more flexible.

In a study by Buss et. al. (1983), it was found that neither 2nd nor 6th graders accuracy (amount recalled) improved following a "make-a-story" instruction compared to an "exact" recall instruction for random ordered stories. But, 6th graders and adults had a higher organization measure for the make-a-story instruction than under the exact recall instruction (for 6th graders, .70 vs .30; for adults, .89 vs .38), however, second graders' organization measure did not vary significantly (.33 vs .46).

In another study, Stein and Nezworski (1978) showed that adults' recall in a slightly disordered condition (the correlation between canonical and scrambled input order was .76) followed story grammar order (tau=.82) more than input order (tau=.72). One factor that could account for the schematic retrieval found in adults' performance in this condition and their more flexible performance in Mandler's research could be the nature of the violation of ideal order. In Stein and Nezworski's case the positions of only two categories were changed, e.g. fifth and sixth became ninth and tenth categories. In another condition of their study, when input order was reversed (the correlation between the canonical and reversed order was -1.0), recall followed the input order more closely (tau=.50) than the story grammar order (tau=.20). In this condition,

subjects were actually more flexible than in the Mandler's work. Another factor operating that could help account for this added flexibility is a difference in the duration between presentation and recall. In Stein and Nezworski's study subjects were required to recall 20 minutes after presentation, so subjects were more likely to be able to hold the input order in memory even though it was meaningless. In contrast, in Mandler's studies the duration was 24 hours. These results give support to Spiro's (1977) assumption that subjects rely more on schemata with the increase in duration between presentation and retrieval.

From these studies a number of factors were identified that affect schema utilization such as subjects' age, degree of disorganization, and the duration between presentation and recall. These factors were considered in designing the present research.

The Proposed Research

Since the present study was designed to examine the three issues raised at the beginning of this paper, a variation of Mandler and DeForest's (1979) paradigm was employed with good and poor readers in grade six. This grade level was chosen because developmental studies (see previous discussion) have shown that by this age normal children have developed a sophisticated "adult like" story schema. The only significant difference between their performance and adults' is that adults are more flexible in their use of a story schema than children in this grade. In addition, reading instruction at this stage is focused on comprehension skills more than decoding. According to Chall (1979), reading at this stage involves the relating of print to ideas rather than the relating of print to speech. Thus, it seemed an optimal grade level to examine individual

differences in story schema utilization. Good and poor readers were simply identified as those who did well or poorly on the comprehension subtest of a standardized reading test.

To serve the first goal of the study, i.e., to determine whether or not poor readers have acquired story schemata, performance in a condition where input was canonical and subjects were instructed to recall canonically (canonical-canonical condition) was compared to a condition where input was interleaved and subjects had to recall in an interleaved format (interleaved-interleaved condition). If poor readers at this age do not have a story schema, presenting a story in a canonical or interleaved order should not affect the amount recalled or the correlation of the recalled order with input order. Consequently, performance in both conditions would be similar. Otherwise, interleaving instructions should depress performance. Based on earlier evidence, (deHirsch et al., 1966; Fry et al., 1970; Smiley et al., 1977), it was expected that comparing performance in these conditions would provide evidence that poor readers utilize a story schema. However, it was also anticipated that they would not perform as well as good readers in the canonical-canonical condition, indicating that their schema is not as well developed or as efficiently utilized as good readers.

To serve the second goal, i.e., to determine whether schematic reproduction is more obligatory for poor than good readers, the degree of correlation between recall order and canonical and interleaved order was compared in the interleaved-interleaved condition. It was anticipated that the correlation between canonical order and recall order would be higher than the correlation beween input (interleaved) and recall order for poor

readers. In contrast, it was anticipated that the correlation between input order and recall order would be higher for good readers. This pattern would indicate that poor readers, like younger chidren, depend on story schemata whereas good readers are capable of using alternate retrieval strategies.

To serve the third goal, i.e., to determine whether good and poor readers differ in their ability to utilize a story schema when cued to do so, performance was assessed by means of a third condition where input order was interleaved and subjects were instructed to recall canonically (interleaved-canonical condition). An effect of cuing was measured both indirectly and directly. Indirect evidence comes from a comparison of performance between the three experimental conditions. Namely, it would be a finding that the correlation of produced order with instructed order in the interleaved-canonical condition was similar to this same correlation in the canonical-canonical condition or greater than the relevant correlation in the interleaved-interleaved conditon. Direct evidence comes from the interleaved-canonical conditon itself. Specifically, it would be a finding that the correlation of produced order with canonical order was greater than the correlation of produced order with interleaved order. It was anticipated that, both in terms of amount recalled and the correlation of recall with canonical order, good readers would perform better than the poor readers.

In summary, it was predicted that the study would provide evidence that both good and poor readers have acquired a story schema. However, it was anticipated that the study would provide evidence that story schemata are more developed or efficently utilized by good readers. In addition, it was expected that good readers would demonstrate a greater

flexibility of use of such schemata both in terms of their ability to ignore or access them as instructed.

To test these hypotheses some modifications were made to the basic paradigm designed by Mandler and DeForest. These modifications were intended to optimize the performance of poor readers. One modification was the difference in duration between presentation of the story and recall. Subjects were asked to recall 30 seconds after the presentation rather than after 24 hours. This was done to minimize forgetting, especially for poor readers.

A second modification was the addition of a reconstruction task. One reason for including a reconstruction task is conceptual: This task is regarded as a superior and less difficult mode of response compared to recall, especially in context of ordering events (e.g., Brown, 1975; Piaget, 1968; Stein & Nezworski, 1978). Piaget pointed out that reconstruction is easier than recall because in reconstruction, the elements are readily available to subjects and it does not require language like recall. In addition, Perfetti and Lesgold (1977) have suggested that the short-term memory codes of less skilled comprehenders may be less specific and less complete than those of good comprehenders, making poor comprehenders less able to retrieve and order information accurately. They cited a study by Noelker and Schumsky (1973), which showed significant differences between good and poor readers in recall but absolutely no differences in recognition. Thus the differences may lie in their functional capacity for coding verbal material, e.g., speed of coding rather than the size of short-term memory per se. Similarly, Stein and Nezworski (1978) pointed out that the demand placed upon working memory is a critical factor in

organizing information. Thus, inability to recall story information according to an ideal structure may be due to problems in storing information rather than a deficiency in having schemata. If poor readers experience difficulty in retrieving information according to an ideal structure or using that structure flexibly because they have problems with the recall task per se, then it is conceivable that they would be able to demonstrate their competence in a reconstruction task. If however, the locus of the problem is the nature of the schema and/or their ability to access it, then use of an easier mode of response should not change the overall picture of performance.

A second reason for including a reconstruction task is methodological: Methods of assessing the ordered nature of recall are dependent on the amount recalled. In most recall tasks, the content of a recall protocol is less than what could have been produced. Therefore, the raw descriptive index calculated can be compared to two kinds of distributions. One is based on what is actually recalled; this deals with the structure of what was recalled. The other is based on all items and deals with both content and structure. Since, it is not yet possible to resolve this distribution problem, in scoring any recall task some subjects are being given undue credit for the structured nature of their recall. The problem is particularly troublesome in contrastive research, like the present study because it was expected that poor readers' recall accuracy would be lower than the good readers (e.g., Smiley et al., 1977; Weaver and Dickson, 1982). As a consequence, any measure chosen will unduly favour either the good or poor readers. Thus, a reconstruction task, which is free from such conditional bias for both good and poor readers, will reflect story

schemata more reliably than recall. (For a detailed discussion of this distribution issue, see Pellegrino and Hubert, 1982).

A final modification was the inclusion of a second phase. In previous studies, a number of stories were presented together, whereas in the present research subjects were presented one story in each of two phases. It was expected that this procedure would reduce memory load, making it easier for subjects to comply with instructions. One important feature of the second phase was that in this phase subjects were informed ahead of time about the format that would be used in presenting and recalling the story. Given this procedure, it was expected that both reading groups would have a chance to improve performance for second story compared to first. However, it was anticipated that explicit cuing would be especially beneficial to poor readers.

Method

Subjects

Subjects were 48 good readers (mean age 11.5 years; 16 males, 32 females) and 48 poor readers (mean age 11.8 years; 24 males, 24 females) from grade six. Good readers were children who scored one half standard deviation above the mean (above 68th percentile) on the comprehension section of a reading achievement test administered by the Edmonton Public School Board to children at the end of grade five. Poor readers scored one half standard deviation below the mean (below the 33rd percentile). All the children had a non-verbal IQ score of 90 or better as indexed by their performance on the Canadian Cognitive Ability Test (1977 version). Teachers' judgement were used as a substitute for IQ scores for three poor readers. In addition, children judged by the teachers to be emotionally impaired or having difficulty with English as a second language were excluded from the sample.

Each reading group was divided equally into three experimental conditions such that subsamples of good and poor readers in conditions were homogeneous with respect to IQ and comprehension percentile (see Table 1).

Insert Table 1 about here

Materials

Two two-episode narratives, previously used by Bisanz, Das and Henderson (1984), were employed after some modifications. Stories were constructed following Mandler and Johnson (1977)'s story grammar. Each

story had a common setting followed by two causally-connected, ending-embeded episodes containing only the basic nodes -- beginning event, reaction, goal, attempt, outcome, and ending.

One story, "The Tiger and the Children" was composed of 164 words and 68 propositions; the other, "The Bear and the Bees", comprised 142 words and 65 propositions (using Kintsch, 1977). Each story was 14 sentences long. The readability level for both stories was grade three (Fry, 1977).

Following Mandler (1978), each story's canonical format was then rearranged to create an interleaved version. In this version, following the setting statements, the six basic nodes of each episode were presented in this fashion: two beginning events (the beginning event of the first episode preceded beginning event of the second episode), two reactions, two goals, two attempts, two outcomes, two endings. Examples of canonical and interleaved versions of a story are shown in Table 2. Propositions in both versions were identical except for the occasional substitution of proper nouns for pronouns in interleaved version to provide unambiguous referents.

For the reconstruction task (see Procedure), sentences of stories were typed on cards. Each card contained one sentence of a story.

Insert Table 2 about here

Design and Procedure

The design was a 2 (reading group) by 3 (experimental condition) by 2 (phase) factorial design with reading group and experimental condition as between-subject factors and phase as a within subject factor. The three

experimental conditions were as follows: (a) canonical presentation-canonical reproduction: where subjects listened to the story in canonical format and were asked to recall and reconstruct the order of sentences "exactly as you heard it on the tape"; (b) interleaved presentation-interleaved reproduction: where subjects heard the story in interleaved format and were told afterwards "you may have noticed that the sentences of the story were mixed up. That's okay, I want you to tell the story just as you heard it"; and (c) interleaved presentation-canonical reproduction: where subjects listened to the story in interleaved format but were told afterwards "you may have noticed that the sentences of the story were mixed up. I want you to tell the story as you think it should be".

All the conditions were composed of two phases. In the first phase, subjects listened to a story, recalled it, and rearranged the order of the sentences. The second phase differed from the first phase in that the subjects knew the exact nature of their task (based on instructions and their experience in the first phase) prior to hearing the story.

Subjects were tested individually in one 30 minute session. Presentation order of stories was counterbalanced across subjects within conditions. In phase one, subjects were told the experimenters were interested in how people remember stories and that they should listen to the story very carefully so that they could recall it. They were told that after the story was finished they would name the colors for 30 seconds and then they would be asked to recall. After probing the children to assure they understood the instructions and after practice naming the colored cards, subjects listened to a story. In order to minimize the effect of short-term memory and rehearsal, subjects were shown 12 colored cards

and were asked to name them as fast as they could following story presentation. Then children were asked to recall the story in accord with their condition. Next, cards containing the numbers 1 to 14 were placed serially on a table and cards containing the sentences of the story, in random order, were given to subjects. They were instructed to arrange the sentences in the same order that they were asked to recall the story by placing the sentences on the numbered cards. The same procedure was followed in the second phase, but in this phase subjects were explicitly told about the format of the story and the way they were to recall and rearrange sentences prior to hearing the story.

All stories and instructions were pre-recorded. Recall protocols were tape recorded by the experimenter. Copies of all instructions and stories are attached in the appendix.

Scoring

Transcribed recall protocols were scored for the presence of statements. The criterion for presence of a statement was the presence of language consistent with the meaning of its essential propositions. (Essential propositions were determined by two independent raters. Interrater agreement was 97%). In the small number of cases where repetition of a statement occurred, the first occurence was used to determine the order of statements recalled. All protocols were scored by one judge. A second judge scored 55% of protocols. Interrater reliability was 99%.

Results and Discussion

Recall Data

There were two forms of analysis for the recall data -- accuracy and order. The index of accuracy was the number of statements recalled by each subject. The index of order was the degree of relationship between produced recall order and the canonical and interleaved orders.

Accuracy. The mean number of statements recalled by each group is shown in Table 3 by condition and phase. An analysis of variance revealed that good readers performed significantly better than poor readers, $F(1,90)=33.92$, $p < .001$. All the readers performed better in the second than the first phase, $F(1,90)=21.00$, $p < .001$. In addition, there was a main effect of condition, $F(2,90)=13.71$, $p < .001$, such that accuracy was higher in the canonical-canonical condition than in the interleaved-interleaved and interleaved-canonical conditions, $F(1,90)=4.29$, $p < .05$, while performance in the later two conditions did not differ, $F(1,90)=1.94$, $p > .05$.

Insert Table 3 about here

These main effects were qualified by a group x condition interaction, $F(2,90)=3.44$, $p < .05$. Analysis of means involved in the interaction indicated that good readers' recall was more accurate than poor readers' in the canonical-canonical, $F(1,90)=21.08$, $p < .001$; and interleaved-canonical conditions, $F(1,90)=18.21$, $p < .001$. However, in the interleaved-interleaved condition, performance was similar, $F(1,90)=1.51$, $p > .05$. For good readers, accuracy was greater in the

canonical-canonical than the interleaved-canonical condition, $F(1,90)=8.85$, $p < .01$, and accuracy was greater in the later condition than in the interleaved-interleaved condition, $F(1,90)=4.83$, $p < .05$. For poor readers, accuracy was also greater in the canonical-canonical than in the interleaved-canonical condition, $F(1,90)=7.03$, $p < .01$. However, there was no difference in their performance between the interleaved-interleaved and canonical-canonical conditions, $F(1,90)=3.28$, $p > .05$, and also between the interleaved-interleaved and interleaved-canonical conditions, $F(1,90)=0.71$, $p > .05$.

The difference in performance for good readers between the interleaved-interleaved and the canonical-canonical conditions can be taken as evidence that they are using a story schema. In fact, cuing these subjects to use a story schema in the interleaved-canonical condition increased the amount of information they recalled relative to their performance in the interleaved-interleaved condition. In contrast, there was no difference in performance for poor readers between the interleaved-interleaved and canonical-canonical conditions. There was even a hint that cuing them to use a story schema in the interleaved-canonical condition may have hindered their performance. Furthermore, there was no differential improvement of poor readers performance in phase two.

Order. As an index of order, a Kendall Tau was computed for each subject for each kind of relationship (produced and canonical; and produced and interleaved orders). Since the accuracy varied from subject to subject it was necessary to transform all the Tau values to Z-scores (Ferguson, 1981; Marascuilo & McSweeney, 1977; Pellegrino & Hubert, 1982). A perfect correlation would receive a Z-score of 4.93 and no

correlation received a Z-score of -.03 when accuracy was maximum (number of statements=14), and when accuracy was minimum (n=4) a perfect correlation would receive a Z-score of 1.70 and no correlation received a Z-score of -.33. The mean Z-score for each group is shown in Table 4 by condition and phase.

Insert Table 4 about here

The degree of relationship between produced and instructed recall order (either canonical or interleaved, see astericks in Table 4) was then analyzed by mixed analysis of variance. The analysis revealed patterns similar to those found in the accuracy data. Good readers performed better than poor readers, $F(1,90)=38.71$, $p < .001$. There was a main effect of condition, $F(2,90)=34.02$, $p < .001$, such that the extent of relationship between produced and instructed recall order was greater in the canonical-canonical than the interleaved-canonical and interleaved-interleaved conditions, $F(1,90)= 18.29$, $p < .001$; the latter two conditions did not vary from each other, $F(1,90)=2.35$, $p > .05$. In addition, all the subjects performed better in the second than the first phase, $F(1,90)=24.30$, $p < .001$.

These main effects were qualified by a group x condition interaction, $F(2,90)=6.00$, $p < .05$. Further analysis of the means involved in the interaction revealed that good readers performed better than poor readers in the canonical-canonical $F(1,90)=14.39$, $p < .001$, and in the interleaved-canonical condition, $F(1,90)=29.88$, $p < .001$. However, in the interleaved-interleaved condition their performance was similar,

$F(1,90)=2.30$, $p > .05$.

For good readers, ordering was better in the canonical-canonical than the interleaved-canonical condition, $F(1,90)=15.64$, $p < .001$; and ordering in the latter condition was better than the interleaved-interleaved condition, $F(1,90)=6.05$, $p < .02$. For poor readers, ordering was also greater in the canonical-canonical than the interleaved-canonical and interleaved-interleaved conditions, $F(1,90)=9.88$, $p < .01$; while ordering in the latter two conditions did not differ, $F(1,90)=2.23$, $p > .05$.

Similar to the accuracy data, better performance for good readers in the canonical-canonical condition compared to the interleaved-interleaved condition can be taken as an evidence that they are using story schema. In fact, cuing these subjects to use a story schema in the interleaved-canonical condition improved their ability to recall in the instructed order compared to their performance in the interleaved-interleaved condition. Unlike the accuracy data, better performance for poor readers in the canonical-canonical condition compared to the interleaved-interleaved condition does provide evidence for use of a story schema. However, they did not perform as well as good readers in the canonical-canonical condition. In addition, cuing poor readers to use a story schema in the interleaved-canonical condition did not improve their ability to recall in the instructed order compared to their performance in the interleaved-interleaved condition. Once again, there was no differential improvement of poor readers' performance in phase two. Note that these conclusions are based on a comparison of Z-scores that are influenced by the amount or accuracy of recall and thus must be considered tentative. However, with the exception of performance in the canonical-canonical condition, the

pattern of the Tau values (shown in Table 4) is also consistent with these conclusions.

To examine directly, (a) the effect of cuing and (b) to see whether or not it is obligatory for subjects to use a story schema in retrieval, the degree of correlation between produced recall order and canonical and interleaved orders in the two interleaved story conditions were compared for each group of subjects (see Table 4, combined columns). Since the correlation between the canonical and interleaved orders was itself high (tau=.67), the focus in this analysis was on whether there was a significant difference in the degree of correlation between produced order and these two orders.

Comparison of these correlations in the interleaved-interleaved condition showed that the relationship between recall order and the instructed (interleaved) order was greater than for the non-instructed (canonical) order for good readers, $t(15)=3.46$, $p < .01$. This was also true for the interleaved-canonical condition, $t(15)=8.77$, $p < .001$. In case of poor readers, the relationship with instructed order was greater than with non-instructed order only in the interleaved-interleaved conditon, $t(15)=3.55$, $p < .01$.

The pattern of correlations for each group of readers within the interleaved-canonical condition provides direct evidence that good readers can use a story schema when cued to do so whereas poor readers cannot. The greater correlation of the produced order with the interleaved order in the interleaved-interleaved condition for both groups suggests that neither group was obliged to retrieve in canonical order. However, the magnitude of the correlation suggests that subjects were not very successful in recalling in

interleaved format either.

Reconstruction Data

The data from the reconstruction task were scored only for order. As such, a Kendall Tau rank order correlation was computed for each subject for each kind of relation (produced with canonical order; and produced with interleaved order). The mean Z-score for each group is shown in Table 5 by phase and condition.

Insert Table 5 about here

The degree of relationship between the order that subjects actually reconstructed the story items and the order that they were instructed to reproduce the items (see astericks in Table 5), was analysed by a mixed analysis of variance. Again, the analysis revealed that good readers performed better than the poor readers, $F(1,90)=15.18$, $p < .001$. In addition, there was a main effect of condition, $F(2,90)=56.58$, $p < .001$, such that the relationship between produced and instructed order was greater in the canonical-canonical than the interleaved-interleaved and interleaved-canonical conditions, $F(1,90)=6.00$, $p < .05$. The relationship was also better in the interleaved-canonical than the interleaved-interleaved condition, $F(1,90)=6.64$, $p < .01$. Finally, performance was better in the second phase than the first phase, $F(1,90)=4.20$, $p < .05$.

These main effects were qualified by two second order interactions. There was a significant group x condition interaction, $F(2,90)=7.92$, $p < .01$. Good readers performed better than poor readers in the canonical-canonical, $F(1,90)=4.81$, $p < .05$; and in interleaved-canonical

conditions, $F(1,90)=25.91$, $p < .001$. However, in the interleaved-interleaved condition performance did not vary, $F(1,90)=0.29$, $p > .05$. For good readers, there was no difference in performance between the canonical-canonical and the interleaved-canonical conditions, $F(1,90)=2.09$, $p > .05$. The orderings in both of these conditions were significantly greater than the ordering in interleaved-interleaved condition, $F(1,90)=16.94$, $p < .001$. Poor readers performed better in the canonical-canonical condition than the interleaved-canonical and interleaved-interleaved conditions, $F(1,90)=10.95$, $p < .01$. Their performance in the interleaved-canonical condition was slightly better than the interleaved-interleaved condition, but as with recall data, th difference was not significant, $F(1,90)=3.10$, $p > .05$. There was also a significant group x phase interaction, $F(1,90)=5.90$, $p < .05$. This interaction was due to poor readers' improved performance in the second phase of all conditions, $F(1,90)=6.70$, $p < .01$; while good readers' performance was similar across the phases, $F(1,90)=0.50$, $p > .05$.

Similar to the recall data, better performance for good readers in the canonical-canonical condition compared to the interleaved-interleaved conditon can be taken as an evidence that they are using a story schema. In fact, in this less demanding task, cuing these subjects to use a story schema in the interleaved-canonical condition allowed them to reconstruct story events as if they had heard them in canonical order originally. The reconstruction data for poor readers exactly paralleled the data obtained in the recall task. The difference in performance for poor readers between the interleaved-interleaved and canonical-canonical conditons provided evidence for use of a story schema. Surprisingly, however they did not perform as

well as good readers in the canonical-canonical conditon. In addition cuing poor readers to use a story schema in the interleaved-canonical condition did not improve their ability to recall in the instructed order relative to their performance in the interleaved-interleaved conditon. Differential improvement of poor readers in phase two was obtained in the reconstruction task.

Once again, to examine directly (a) the effect of cuing and (b) whether or not it is obligatory for subjects to use a schema in the reconstruction task, the degree of correlation between the produced order and canonical and interleaved orders in the two interleaved story conditons were compared for each group of subjects (see Table 5, combined columns). For good readers, comparison of these correlations in interleaved-canonical condition showed that, as with recall the correlation with instructed order (canonical) was greater than with the non-instructed (interleaved) order, $t(15)=15.66$, $p < .001$. For poor readers, in contrast to the recall data, the correlation with the instructed order was also greater than with the non-instructed order, $t(15)=5.09$, $p < .01$. Also different from recall, a comparison of the correlation with instructed (interleaved) and non-instructed (canonical) ordering in the interleaved-interleaved condition showed no advantage for the instructed order for good readers, $t(15)=0.58$, $p > .05$ or for poor readers, $t(15)=0.25$, $p > .05$.

The pattern of correlations for both good and poor readers within the interleaved-canonical condition provides evidence that they can use a story schema when cued to do so. Equivalent correlations between reconstructed order and canonical and interleaved (instructed) orders in the interleaved-interleaved conditon revealed that the advantage for interleaved

order found in free recall for both types of readers disappeared in reconstruction task. Thus, while canonical reconstruction may not be obligatory, interleaved reconstruction does not come easily.

General Discussion

The present study addressed three questions: (a) the extent to which good and poor readers differ in their recall of stories according to a story schema; (b) whether or not they can use alternate retrieval strategies or retrieval is strictly schema-based and (c) whether or not they can use a story schema when cued to do so. The answers to these questions varied depending upon whether a less demanding reconstruction task or a more demanding recall task was used to assess performance.

The hypotheses initially described in the introduction section of this paper essentially suggested that while poor readers in grade six would have a story schema, it would not be as well-developed or as efficiently or flexibly utilized as the schema of good readers. In the context of reconstruction task, the picture of poor readers' performance that emerges is more optimistic than initially hypothesized. Better performance in the canonical-canonical condition than the interleaved-interleaved condition provided evidence that both good and poor readers were using a story schema. However, as expected poor readers did not perform as well as good readers in the canonical-canonical condition indicating their story schema is not as well developed or as efficiently utilized (or both) as that of good readers.

Contrary to expectation, for both good and poor readers the correlation between produced order and interleaved order was similar to the correlation of produced order and canonical order in the interleaved-interleaved condition. While this finding shows that schematic strategy is not obligatory for either poor readers or good readers, it also shows that neither good nor poor readers could use an alternative strategy

efficiently.

As hypothesized, when cued to use a story schema, good readers performed as if they heard the stories in canonical order. Cuing did not benefit poor readers compared to their performance when instructed to interleave stories. However, this is only an indirect evidence of cuing. Some direct and unexpected evidence of use of a story schema by poor readers was found in interleaved-canonical condition where the correlation of produced order with canonical order was greater than the correlation of produced order with interleaved order. Finally, as anticipated, only poor readers benefited from explicit cuing in the second phase.

Thus, the picture that emerged from the reconstruction data is one of a well-developed, efficiently and flexibly utilized schema for good readers and a less-developed (or less-efficient) but still flexibly utilized schema for poor readers.

This fairly optimistic picture changed when a more demanding recall task was used to assess performance. Better performance, in terms of both accuracy and order, by good readers in the canonical-canonical condition compared to the interleaved-interleaved condition confirmed that good readers possess a story schema. In contrast, poor readers' recall accuracy in the canonical-canonical conditon was similar to that of the interleaved-interleaved conditon. This could imply that poor readers do not have a story schema. However, accuracy per se does not provide information about the structure of recall; given the reconstruction data, a more likely explanation is that they have a schema but under the greater task demands imposed by recall task it is not well developed or utilized efficiently enough to enhance recall accuracy. In fact, the order data

supports this interpretation: The correlation with instructed order in the canonical-canonical condition was greater than that of the interleaved-interleaved conditon, suggesting that poor readers do have a story schema. Similar to the reconstruction task, poor readers did not perform as well as good readers in the canonical-canonical condition. However, this comparison is based on Z-scores and it is compromised by the fact that it conflicts with an informal comparison of their performance based on Tau values.

With respect to the use of alternative retrieval strategies, for both good and poor readers the correlation of produced order with interleaved order was greater than the correlation of produced order with canonical order in the interleaved-interleaved condition. This provides evidence that schematic strategy is not obligatory either for good or for poor readers. Surprisingly, in comparison to the reconstruction task, children were better able to maintain an interleaved order in the more demanding recall task. It may be that the demands on memory imposed by the recall task force a reliance on the original encoding of the material while in the reconstruction task they are free to ignore the encoded representation of the story and rely more on their prototypic knowledge of the story. If this is the case, the story schema will have greater influence on performance in reconstruction than in recall.

In addition, cuing good readers to use a story schema in the interleaved-canonical condition improved the accuracy and correlation of their recall with instructed order relative to their performance in the interleaved-interleaved condition. There was no significant effect of cuing for poor readers. However, once again this was only indirect evidence for

lack of a cuing effect. Direct evidence of good readers' flexibility and poor readers' inflexibility came from comparing the correlations of produced order with canonical and interleaved orders in the interleaved-canonical condition. Here, the correlation of produced order with canonical order was greater than the correlation with interleaved order for good readers but not for poor readers. Finally, both good and poor readers performed better in the second phase compared to the first phase. This suggests that even the good readers need explicit cuing in the more demanding recall task.

Thus, the picture that emerges of good readers' performance from the more demanding recall task is once again of individuals' process of well-developed, efficiently and flexibly utilized schema. In contrast, any hint of flexibility for poor readers disappears under these conditions.

The changing picture of performance that emerged from the two tasks utilized here points to the importance of assessing schema utilization under differing task demands: A much clearer picture of the strengths and weaknesses of good and poor readers was revealed than would have resulted from using a single task. In addition, the findings provide support for the point made by Perfetti and Lesgold (1977) that problems in coding verbal material in memory prevent poor readers from organising information schematically. The performance differences in the recall and reconstruction tasks as obtained in this study for both good and poor readers indicate that demand on memory is a critical factor for organizing information schematically. In addition, methodologically, it was important to use two tasks because if recall data alone is obtained, it is not possible to separate the structure from the content of the information recalled.

It is important to point out that regardless of the tasks used to assess perfromance the good readers' better performance is accounted for by use of a story schema: Both the recall and reconstruction data showed that good readers performed better in the canonical reproduction conditions compared to the interleaved reproduction condition. Only in the interleaved-interleaved condition where use of a story schema was not possible, their performance was similar to that of the poor readers.

Based on the present study, it is possible to suggest that the story grammar approach does provide information regarding the way poor readers differ from good readers. In several earlier studies (e.g., Mandler & Johnson, 1977; Stein & Glenn, 1979; Weaver & Dickson, 1982; Worden et al., 1982), the pattern of nodes recalled, i.e., the frequency of recall of different nodes in well-formed stories, was employed as the criterion for assessing the use of a story schema. Using this measure, no qualitative differences were found either among different age groups or among different subsamples (e.g., normal and disabled readers). Weaver and Dickson, therefore, were skeptical about the effectiveness of the story grammar approach in understanding the problems of poor readers. The present study showed that the approach can be informative given that an effective measure of schema utilization is employed.

The potential success of the story grammar framework for identifying certain problems of poor readers is encouraging because the ability to clearly identify the problems of poor readers is critical to the development of intervention programs. Within the limited context of this study it was not possible to shed any light on the issue of why poor readers do not develop or utilize story schema as well as good readers.

However, the study did answer one of the pressing questions raised by some education researchers (Rand, 1984; Whaley, 1981). Namely, it provided evidence that there is a large group of poor readers whose performance is characterised by a poor grasp of story structure. In addition, based on the results it is possible to suggest that standardized reading comprehension tests can be used to identify groups of readers who have this problem.

A number of researchers (e.g., Gordon & Braun, 1983; Olson, 1984; Sadaw, 1982) have advocated instruction on story grammar in the classroom to help children, especially poor comprehenders. These educators have suggested that story schemata can help children to focus on story elements, sequence events and, thereby, to develop a logical framework. This in turn should help them to grasp major points in a discourse, integrate stated facts with existing knowledge and elicit an inferential level of thought. In fact, some researchers (e.g., Buss et.al., 1983; Fitzgerald and Spiegel, 1983) have obtained improvement in reading comprehension after training on story grammar categories in young children and readers who, after extensive assessment, were shown to be deficient in their knowledge of narrative structure. Indeed, the present study showed that poor readers could improve their performance with explicit cuing after only one trial. Extrapolating these findings, we can expect that it would be possible to help poor readers to become better comprehenders by helping them to develop and utilize knowledge of discourse structures.

TABLES

Table 1

Characteristics of Children in the Six Subgroups

Group	Experimental Conditions	N	IQ		Comprehension Percentile	
			Mean	Range	Mean	Range
Good Readers						
	CANONICAL-CANONICAL	16	115.69	96-143	86.00	71-98
	INTERLEAVED-CANONICAL	16	114.25	95-145	86.19	69-98
	INTERLEAVED-INTERLEAVED	16	116.81	98-137	87.13	71-97
Poor Readers						
	CANONICAL-CANONICAL	16	98.07	91-120	19.63	03-32
	INTERLEAVED-CANONICAL	16	98.73	91-112	17.37	01-32
	INTERLEAVED-INTERLEAVED	16	100.87	91-114	17.38	01-32
			F for groups=54.88*		F for groups=1479.07*	
			F for conditions=0.44		F for conditions=0.12	
			F for Group x Condition=0.81		F for Group x Condition=0.33	

a: Scores are from the non-verbal section of the Canadian Cognitive Abilities Test (including sections on figure classification, figural analogies and figure synthesis)
b: Percentiles are from the comprehension section of the Edmonto Public School Board's Reading Achivement Test.
* : $p < .001$

Table 2

An Example of a standard and an interleaved story

Standard Version

Setting: Once a brother and a sister lived in a house near the woods. Each day they baked a cake or pie for dinner and left it on the window to cool.

Episode 1

Beginning: One day a tiger came by the house and smelled their cake.

Reaction: The tiger really liked the smell of the cake.

Goal: He wanted to have the cake for himself.

Attempt: So the tiger walked up to the window and knocked the cake with his paw.

Outcome: Then the tiger ate the cake singing happily to himself.

Ending: When the cake was gone, the tiger felt very good indeed.

Episode 2

Beginning: Feeling very hungry again, the next day the tiger came back for more.

Reaction: When the children saw the tiger return they became very mad.

Goal: They wanted to get even with this tiger.

Attempt: So the children baked a pie and filled the centre with ants.

Outcome: When the tiger ate the pie he gave a cry of surprise.

Ending: From that day on the tiger never came back to eat the children's food.

Interleaved Version

Setting: Once a brother and a sister lived in a house near the woods. Each day they baked a cake or pie for dinner and left it on the window to cool.

Beginning 1: One day a tiger came by the house and smelled their cake.

Beginning 2: Feeling very hungry again, the next day the tiger came back for more.

Reaction 1: The tiger really liked the smell of the cake.

Reaction 2: When the children saw the tiger return they became very mad.

Goal 1: The tiger wanted to have the cake for himself.

Goal 2: The children wanted to get even with this tiger.

Attempt 1: So the tiger walked up to the window and knocked the cake with his paw.

Attempt 2: So the children baked a pie and filled the centre with ants.

Outcome 1: Then the tiger ate the cake singing happily to himself.

Outcome 2: When the tiger ate the pie, he gave a cry of surprise.

Ending 1: When the cake was gone, the tiger felt very good indeed.

Ending 2: From that day on the tiger never came back to eat the children's food.

Table 3

Mean of Number of Items Recalled

		First Phase	Second Phase	Combined
Good Readers				
	CANONICAL-CANONICAL	11.38	11.91	11.65
	INTERLEAVED-CANONICAL	9.63	10.88	10.26
	INTERLEAVED-INTERLEAVED	8.69	9.69	9.19
Poor Readers				
	CANONICAL-CANONICAL	9.06	9.88	9.47
	INTERLEAVED-CANONICAL	7.56	8.81	8.19
	INTERLEAVED-INTERLEAVED	8.25	8.94	8.60

Table 4

Mean Z-Scores of Correlations for Order in Recall

		RO. x Canonical Order			RO. x Interleaved Order		
		First Phase	Second Phase	Combined	First Phase	Second Phase	Combined
Good Readers							
	CANONICAL-CANONICAL	4.28(.99)*	4.45(1.0)*	4.37(.99)	2.97(.70)	3.09(.70)	3.03(.70)
	INTERLEAVED-CANONICAL	3.34(.88)*	4.10(.97)*	3.72(.93)	2.86(.75)	3.02(.73)	2.94(.74)
	INTERLEAVED-INTERLEAVED	2.63(.75)	3.11(.81)	2.84(.78)	3.13(.89)*	3.43(.90)*	3.28(.89)
Poor Readers							
	CANONICAL-CANONICAL	3.59(.98)*	3.86(.99)*	3.72(.98)	2.04(.57)	2.72(.71)	2.38(.64)
	INTERLEAVED-CANONICAL	2.52(.82)*	3.02(.85)*	2.77(.83)	2.63(.83)	2.83(.80)	2.73(.81)
	INTERLEAVED-INTERLEAVED	2.42(.71)	2.64(.74)	2.53(.72)	2.78(.81)*	3.27(.91)*	3.03(.85)

RO. : Recall order
* : Instructed recall order
Parenthesis : Tau values

Table 5

Mean Z-Scores of Correlations for Order in Reconstruction

		RO. x Canonical Order			RO. x Interleaved Order		
		First Phase	Second Phase	Combined	First Phase	Second Phase	Combined
Good Readers							
	CANONICAL-CANONICAL	4.90*	4.91*	4.90	3.26	3.27	3.26
	INTERLEAVED-CANONICAL	4.69*	4.71*	4.70	3.21	3.31	3.27
	INTERLEAVED-INTERLEAVED	3.80	3.61	3.70	3.68*	3.56*	3.62
Poor Readers							
	CANONICAL-CANONICAL	4.50*	4.67*	4.56	3.10	3.11	3.10
	INTERLEAVED-CANONICAL	3.72*	4.19*	3.95	3.38	3.11	3.25
	INTERLEAVED-INTERLEAVED	3.74	3.50	3.63	3.46*	3.89*	3.69

RO. : Reconstructed order
* : Instructed reconstruction order

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APPENDIX

Condition: Canonical Presentation-Canonical Reproduction

Recall

Phase 1

We are interested in how people remember stories. Today, you will listen to some stories which are recorded on this tape. Listen to each story very carefully and try to remember it. When the story is finished, for 30 seconds you will be shown some colored cards. You have to name the colors. Then you will recall the story. Your recall will be recorded.

Do you have any question? (If no) Okay, could you tell me what is going to happen?

Tell me what will happen at first. What will happen when the story is finished? Okay, lets practice the colored cards. .....

Then what will you do?

(If there is any question, answer the question, if the subject could not tell anything, let the subject listen to the instructions again, and then start from the beginning.)

Are you ready? (If yes) Okay, listen to the story.

The Tiger And The Children

Once a brother and a sister lived in a house near the woods.
Each day they baked a cake or pie for dinner and left it on the window to cool.
One day a tiger came by the house and smelled their cake.
The tiger really liked the smell of the cake.

He wanted to have the cake for himself.
So the tiger walked up to the window and knocked the cake with his paw.
Then he ate the cake, singing happily to himself.
When the cake was gone, the tiger felt very good indeed.
Feeling very hungry again, the next day the tiger came back for more.
When the children saw the tiger return, they became very mad.
They wanted to get even with this tiger.
So the children baked a pie and filled the centre with ants.
When the tiger ate the pie he gave a cry of surprise.
From that day on, the tiger never came back to eat the children's food.

(Before recalling) Recall the story exactly as you heard it on the tape. Tell me the story.

Reconstruction

Phase 1

Here are the sentences of the story (as being shown). Read each of the sentences on the card one by one. Put the sentences just in the order you have listened to them on the tape. Tell me when you are finished. Then I will have you check over your work.

Place the sentences in this way....., first sentence will be on top of number one card, second sentence on top of number two card. In this way the last sentence will be on card number fourteen.

.....

Do you have any question? (If no) Tell me what are you going to do. Are you ready? (If yes) Okay, go ahead.

.....

(Child indicates he/she is finished.)

Okay, check over your work by reading the sentences from one to fourteen. Are they in the order that you heard them on the tape? (If yes) Stop. (If no) Okay, put them in the order that you have listened to them on the tape.

Recall

Phase II

Now you will listen to another story just as you did before. Listen to the story very carefully and try to remember it. When the story is finished, you will be shown the colored cards for 30 seconds and you have to name the colors. Then you will recall the story. Reacall the story just as you heard it on the tape. Your recall will be recorded.

.....

Do you have any question? (If no) Okay, Tell me what will happen? What will happen at first? What will happen when the story is finished? Then what will you do?

Are you ready? (If yes) Okay, listen to the story.

The Bear And The Bees

Once there were some bees and a bear.
The bees lived in a tree near the bear's house.
One day the bees went away, leaving their honey behind.
The bear was very surprised to see the bees leave.
He thought that now was a good time to eat their honey.
So the bear walked over to the tree and climbed it.
Then he ate all of the honey very quickly.
Feeling very full, the bear walked home happily.
Soon after the bear left, the bees came back and saw that their honey was gone.
The bees knew that the bear had stolen their honey.
They wanted to punish the bear.
So the bees flew all around looking for the thief.
When they found the bear they bit him all over.
Never again did the bear take anything from his little friends.

(Before recalling) Recall the story exactly as you heard it on the tape. Tell me the story.

Reconstruction

Phase II

Here are the sentences of the story (as being shown). Read each of the sentences on the cards one by one. Put the sentences just in the order you have listened to them on the tape. Tell me

when you are finished. Then I will have you check over your work. Place the sentences in this way, first sentence on top of number one card, second sentence on top of number two card. In this way the last sentence you have heard will be on top of card number fourteen.

Do you have any question? (If no) Tell me what are you going to do.

Are you ready? Okay, go ahead.

(Child indicates he/she is finished.) Okay, check over your work by reading the sentences from one to fourteen. Are they in the order that you have heard them on the tape? (If yes) Stop. (If no) Okay, put them in the order that you have listened to them.

Condition: Interleaved Presentation-Interleaved Reproduction

Recall

Phase I

We are interested in how people remember stories. Today, you will listen to some stories which are recorded on this tape. Listen to each story very carefully and try to remember it. When the story is finished, for 30 seconds you will be shown some colored cards. You have to name the colors. Then you will recall the story. Your recall will be recorded.

Do you have any question? (If no) Okay, could you tell me what is going to happen?

Tell me what will happen at first. What will happen when the story is finished? Okay, lets practice the colored cards. .....

Then what will you do?

(If there is any question, answer the question . If the subject could not tell anything, let the subject listen to the instructions again, and then start from the beginning.)

Are you ready? (If yes) Okay, listen to the story.

The Tiger And The Children

Once a brother and a sister lived in a house near the woods. Each day they baked a cake or pie for dinner and left it on on the window to cool

One day a tiger came by the house and smelled their cake. Feeling very hungry again, the next day the tiger came back for more.

The tiger really liked the smell of the cake.
When the children saw the tiger return, they became very mad.
The tiger wanted to have the cake for himself.
The children wanted to get even with this tiger.
So the tiger walked up to the window and knocked the cake with his paw.
So the children baked a pie and filled the centre with ants.
Then the tiger ate the cake, singing happily to himself.
When the tiger ate the pie he gave a cry of surprise.
When the cake was gone, the tiger felt very good indeed.
From that day on the tiger never came back to eat the children's food.

(Before recalling) You may have noticed that the order of sentences of the story were mixed up. That's okay, I want you to recall the story just as you heard it on the tape. Tell me the story.

Reconstruction

Phase I

Here are the sentences of the story (as being shown). Read each of the sentences on the card one by one. Put the sentences just in the order you have listened to them on the tape. Tell me when you are finished. Then I will have you check over your work. Place the sentences in this way, first sentence will be on top of number one card, second sentence on top of number two card. In this way the last sentence that you have heard will be on top

of card number fourteen.

Do you have any question? (If no) Tell me what are you going to do?..... Are you ready? (If yes) Okay, go ahead.

(Child indicates he/she is finished.) Okay, check over your work by reading the sentences from one to fourteen. Are they in the order that you heard them on the tape? (If yes) Stop. (If no) Okay, put them in the order that you have listened to them on the tape.

Recall

Phase II

Now you will listen to another story just as you did before. Again the sentences will be mixed up. Listen to the story very carefully and try to remember it. When the story is finished, you will be shown the colored cards for 30 seconds, and you have to name the colors. Then you will recall the story. Recall the story just as you heard it on the tape. Your recall will be recorded.

Do you have any question? (If no) Okay, tell me what will happen at first? How will be the order of sentences of the story? How will you recall the story? What will happen when the story is finished? Then what will you do? Are you ready? (If yes) Okay, listen to the story.

The Bear And The Bees

Once there were some bees and a bear.

The bees lived in a tree near the bear's house.

One day the bees went away, leaving their honey behind.
Soon after the bear left, the bees came back and saw that their honey was gone.
The bear was surprised to see the bees leave.
The bees knew that the bear had stolen their honey.
The bear thought that now was a good time to eat their honey.
The bees wanted to punish the bear.
So the bear walked over to the tree and climbed it.
So the bees flew all around looking for the thief.
Then the bear ate all of the honey very quickly.
When the bees found the bear they bit him all over.
Feelng very full, the bear walked home happily.
Never again did the bear take anything from his little friends.

(Before recalling) The sentences of the story were mixed up. Remember I want you to recall the story exactly as you heard it on the tape. Tell me the story.

Reconstruction

Phase II

Here are the sentences of the story (as being shown). Read each of the sentences on the card one by one. Put the sentences just in the order you have listened to them on the tape. Tell me when you are finished. Then I will have you check over your work. Place the sentences in this way, first sentence on top of card number one, second sentence on top of card number two. In

this way the last sentence that you have heard will be on top of card number fourteen.

Do you have any question? (If no) Tell me what are you going to do? Are you ready? (If yes) Okay, go ahead. (Child indicates he/she is finished.) Okay,check over your work by reading the sentences from one to fourteen. Are they in the order that you heard them on the tape? (If yes) Stop. (If no) Okay, put them in the order that you have listened to them.

Condition: Interleaved Presentation-Canonical Reproduction

Recall

Phase 1

We are interested in how people remember stories. Today, you will listen to some stories which are recorded on this tape. Listen to each story very carefully and try to remember it. When the story is finished, for 30 seconds you will be shown some colored cards. You have to name the colors. Then you will recall the story. Your recall will be recorded.

Do you have any question? (If no) Okay, could you tell me what is going to happen?

Tell me what will happen at first. What will happen when the story is finished? Okay, lets practice the colored cards. .....

Then what will you do?

(If there is any question, answer the question, if the subject could not tell anything, let the subject listen to the instructions again, and then start from the beginning.)

Are you ready? (If yes) Okay, listen to the story.

The Tiger And The Children (The Interleaved Format which has been presented in the earlier section)

(Before recalling) You may have noticed that the order of sentences of the story were mixed up. I want you to recall the story as you think it should be. Okay, tell me the story.

Reconstruction

Phase I

Here are the sentences of the story (as being shown). Read each of the sentences one by one. Put the sentences in the order that you think they should be. Tell me when you are finished. Then I will have you check over your work. Place the sentences in this way, first sentence on top of number one card, second sentence on top of number two card. In this way the last sentence that you think should be will be on top of card number fourteen.

Do you have any question? (If no) Tell me what are you going to do?..... Are you ready? (If yes) Okay, go ahead.

(Child indicates he/she is finished.) Okay, check over your work by reading the sentences from one to fourteen. Are they in the order that you think they should be? (If yes) Stop. (If no) Okay, put them in the order that you think they should be.

Recall

Phase II

Now you will listen to another story just as you did before. Again the sentences will be mixed up. Listen to the story very carefully and try to remember it. When the story is finished, you will be shown the colored cards for 30 seconds, and you have to name the colors. Then you will recall the story. Recall the story as you think it should be. Your recall will be recorded.

Do you have any question? (If no) Okay, tell me what will happen at first? How will be the order of sentences of the story? How will you recall the story? What will happen when the story is finished? What will you do?

Are you ready? (If yes) Okay, listen to the story.

The Bear And The Bees (The Interleaved Format, which has been presented in the earlier section)

(Before recalling) Sentences of the story were mixed up. Remember I want you to recall the story as you think it should be. Tell me the story.

Reconstruction

Phase II

Here are the sentences of the story (as being shown). Read each of the sentences on the card one by one. Put the sentences in the order that you think they should be. Tell me when you are finished. Then I will have you check over your work. Place the sentences in this way, first sentence on top of card number one, second sentence on top of card number two. In this way the last sentence that you think should be will be on top of card number fourteen.

Do you have any question? (If no) Tell me what are you going to do?.....

Are you ready? (If yes) Okay, go ahead.

(Child indicates he/she is finished.) Okay, check over your work by reading the sentences from one to fourteen. Are they in the order that you think they should be? (If yes) Stop. (If no) Okay, put them in the order that you think they should be.